

Report to Congress on the Prohibition of Export of Certain Mercury Compounds



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Background

Statutory Requirements

The U.S. Environmental Protection Agency (EPA) was directed by Congress to publish in the Federal Register a list of mercury compounds that are prohibited from export, not later than 90 days after the date of enactment of the Frank R. Lautenberg Chemical Safety for the 21st Century Act (the Lautenberg Act), which amended the Toxic Substances Control Act (TSCA). The Lautenberg Act was enacted on June 22, 2016 and EPA published the requisite list of mercury compounds that were to be prohibited from export on August 12, 2016. Effective January 1, 2020, the statute prohibits the export of: mercury (I) chloride or calomel; mercury (II) oxide; mercury (II) sulfate; mercury (II) nitrate; and cinnabar or mercury sulphide,¹ unless those mercury compounds are exported to one of the member countries of the Organisation for Economic Co-operation and Development (OECD) for environmentally sound disposal, on the condition that no mercury or mercury compounds so exported are to be recovered, recycled, or reclaimed for use, or directly reused, after such export. These provisions of the Lautenberg Act complement the 2008 Mercury Export Ban Act (MEBA).²

This report is submitted to fulfill TSCA section 12(c)(7)(E), which states:

(E) REPORT.—Not later than 5 years after the date of enactment of the Frank R. Lautenberg Chemical Safety for the 21st Century Act, the Administrator shall evaluate any exports of mercury compounds on the list published under subparagraph (B) for disposal that occurred after such date of enactment and shall submit to Congress a report that—

- (i) describes volumes and sources of mercury compounds on the list published under subparagraph (B) exported for disposal;
- (ii) identifies receiving countries of such exports;
- (iii) describes methods of disposal used after such export;
- (iv) identifies issues, if any, presented by the export of mercury compounds on the list published under subparagraph (B);
- (v) includes an evaluation of management options in the United States for mercury compounds on the list published under subparagraph (B), if any, that are commercially available and comparable in cost and efficacy to methods being utilized in such receiving countries; and
- (vi) makes a recommendation regarding whether Congress should further limit or prohibit the export of mercury compounds on the list published under subparagraph (B) for disposal.

Data Gathering and Limitations

Data were gathered by EPA's Office of Land and Emergency Management (OLEM) utilizing available reporting sources for hazardous waste export shipments such as EPA's Waste Import Export Tracking System (WIETS) and the U.S. Customs and Border Protection's Automated Export System (AES). AES data reflect pre-shipment Electronic Export Information (EEI) filings that include the waste stream

¹ 15 U.S.C. § 2611(c)(7)(A)(i)-(v). TSCA section 12(c)(7) uses the term “mercury sulphide,” which is an alternative spelling of “mercury sulfide.” Throughout this report, EPA is using “mercury sulfide” to be consistent with how the chemical substance is listed in the TSCA Chemical Substance Inventory.

² The Mercury Export Ban Act of 2008 (Pub. L. No. 110-414). Note that while TSCA allows the export of mercury compounds to OECD countries for treatment and disposal, as a general matter MEBA prohibits the export of elemental mercury, including for treatment and disposal.

consent number issued by EPA for the hazardous waste being exported. Annual report data submitted to EPA for a given reporting year reflect export shipments that departed the United States in the reporting year, adjusted to reflect any receiving facility re-weighs or rejections.

Data from 2018 and 2019. Electronic annual report data for 2018 and 2019 were first filtered to find entries listing one or more of the following parameters:

1. A waste description that included “mercury” in the text and listed the specific international hazardous waste code of A1030, used by the OECD. This code is defined as waste having any constituents or contaminants of mercury, mercury compounds, arsenic, arsenic compounds, thallium, or thallium compounds; or
2. Any of the following U.S. Department of Transportation hazardous material identification numbers: UN1624 (mercuric chloride), UN1625 (mercuric nitrate), UN1627 (mercurous nitrate), UN1641 (mercury oxide), UN1645 (mercury sulfates), UN2024 (Mercury compound, liquid, n.o.s), or UN2025 (Mercury compound, solid, n.o.s). Some companies may only have a certain type of mercury compound which is destined for disposal and may use one of these specific UN identification numbers.

Those entries were then reviewed, and the following items were excluded:

1. Any entry listing that was known not to be relevant for the disposal of any of the five listed compounds: dental amalgam (does not contain the listed compounds), batteries (are specifically destined for recycling), and “mercury, bulk and ‘labpacks’” (are not part of a relevant waste stream description); or
2. Any entry listing zero quantity shipped (since exporters have to report regardless of whether the shipment actually occurred; this exclusion eliminates miscounting).

Data from 2016 and 2017. Prior to 2018, annual reports of hazardous waste exports were largely submitted in paper format, creating certain data collection limitations for 2016 and 2017. However, paper copies of the 2016 and 2017 hazardous waste export annual reports were reviewed following similar criteria used for the 2018 and 2019 data.

Other Data and Outreach. Agency data from 2020 are not included in this report. Per the hazardous waste export annual report requirements in 40 CFR 262.83(g), the submission deadline is March 1 to report on export shipments made during the previous calendar year. As such, final data from electronically submitted hazardous waste export annual reports for reporting year 2020 were not available in a timely manner to meet the statutory deadline of June 22, 2021 for this report.

Finally, specific outreach was conducted to provide some relevant, additional information. Export data of one specific mercury compound was voluntarily provided by Bethlehem Apparatus Company Inc.³ Due to these submissions, some 2020 data were available for this report.

Waste Management

The Resource Conservation and Recovery Act (RCRA) is the public law that provides the authority and creates the framework for the environmentally sound management of hazardous and non-hazardous solid waste. RCRA provides for “cradle to grave” management of hazardous waste to ensure it is handled in a manner that protects human health and the environment and therefore establishes regulations addressing

³ Bethlehem Apparatus Company Inc. 890 Front St. Hellertown, PA 18055. Referred to in this report as Bethlehem Apparatus.

the generation, transportation, and treatment, storage, and disposal of hazardous wastes. EPA identifies wastes as hazardous using two different approaches: narrative listings of particular wastes as hazardous (often from a particular manufacturing process), and hazardous properties, or characteristics which if exhibited by a waste would result in it being identified as hazardous. Different mercury-bearing wastes are classified as hazardous under each of these approaches.

RCRA regulations use waste codes to identify the types of hazards posed by hazardous wastes. Assignment of applicable waste codes by the generator allows subsequent handlers of the waste (i.e., transporters and treatment/disposal facilities) to manage the waste safely and ensure that it is appropriately treated to reduce risks and/or hazards before it is disposed. Key waste codes for mercury wastes include U151, which identifies pure elemental mercury that is surplus and being discarded, and D009, which identifies a waste as having significant potential to leach mercury and contaminate groundwater when landfilled. Other codes identify wastes generated by industrial processes that use mercury (such as vinyl chloride monomer production and the mercury cell process for producing chlorine). However, most of these processes are no longer used in the United States.⁴ Waste generators are required to determine whether their waste is a hazardous waste, and once identified as hazardous, may store the waste on-site for up to 90 days. After 90 days, generators must ship hazardous waste to a permitted treatment/storage/disposal (TSD) facility for treatment and disposal. TSD facilities may store hazardous waste for up to one year, to facilitate more efficient treatment and disposal.

RCRA requires the appropriate treatment of hazardous wastes before they may be disposed in landfills. Mercury wastes are divided into two general categories for treatment purposes: low concentration mercury wastes and high concentration wastes. Low concentration mercury wastes (those containing less than 260 mg/kg mercury) may undergo stabilization treatment and then can be landfilled. High concentration mercury wastes (containing 260 mg/kg or more mercury) must undergo thermal processing (retorting) to drive off and recover the mercury. There is currently no option for land disposal of high concentration mercury waste in the United States (with the exception of radiologically contaminated waste, because recovered mercury cannot be decontaminated and so cannot be sold). Before MEBA, recovered mercury which was non-radiologically contaminated could either be sold domestically or exported. However, the implementation of MEBA curtailed export, thereby directing more mercury into long-term management and storage as waste. Additional export and storage issues related to MEBA are discussed in “Issues Presented by the Export of Mercury Compounds.”

RCRA also provides for the import and export of hazardous wastes. U.S. generators seeking to export a hazardous waste must notify EPA of the proposed export, and EPA provides notice to the receiving country. The shipment may proceed only after the receiving nation consents to the import of the waste. The United States has a bilateral agreement with Canada to facilitate the import and export of hazardous wastes.

Sources, Volumes, and Disposal of Mercury Compounds as Waste

Sources and Volumes of Exported Mercury Compounds

There are approximately thirty-five U.S. companies across several sectors engaged in the export of mercury compounds from the United States. Due to the nature of hazardous waste designations under RCRA, specific quantities of each compound cannot always be determined. Hazardous waste destined for

⁴ There is one U.S. chlor-alkali facility using the mercury cell process, and the vinyl chloride production process that relies on mercury has not been used since 2000.

disposal is rarely separated out by specific compounds and usually includes a wide variety of substances, some of which may have contained one or more of the five mercury compounds that are prohibited from export. Where specified in the export annual report data or provided during outreach, some mercury compounds, such as mercury (I) chloride and mercury sulfide, are reported by compound (Table 1).

It is important to note that due to the nature of hazardous waste disposal and processing, the “All other mercury compounds” description in Table 1 may include other hazardous material such as mercury compounds not on the list of compounds prohibited from export, contaminated soil, or other hazardous contaminants. Therefore, this category may not reflect the true nature of exported mercury compound waste. Because hazardous waste is processed in similar circumstances, regardless of origin or chemical makeup, waste is not weighed, processed, or recorded by specific compound unless that shipment is specified as containing a homogenous substance.

Table 1. Export of Mercury Compounds by Year

| | Mercury Compound | Weight (metric tons) |
|-------------------------|--------------------------------|-----------------------------|
| 2020⁵ | Mercury sulfide (cinnabar) | 22.31 |
| 2019 | Mercury (I) chloride (calomel) | 733.95 |
| | Mercury sulfide (cinnabar) | 34.04 |
| | All other mercury compounds | 100.09 |
| 2018 | Mercury (I) chloride (calomel) | 615.55 |
| | Mercury sulfide (cinnabar) | 17.72 |
| | All other mercury compounds | 393.79 |
| 2017 | Mercury (I) chloride (calomel) | 186.88 |
| | Mercury sulfide (cinnabar) | 34.27 |
| | All other mercury compounds | 131.35 |
| 2016 | Mercury (I) chloride (calomel) | 158.7 |
| | Mercury sulfide (cinnabar) | 17.22 |
| | Mercury (II) nitrate | 0.32 |
| | All other mercury compounds | 127.06 |

Receiving Countries

The five mercury compounds being exported for environmentally sound disposal can only be exported to member countries of the OECD. Currently, Canada is the only OECD country with whom the United States has a bilateral agreement that meets the Basel Convention⁶ requirements to allow Canada to accept and process the five prohibited mercury compounds for hazardous waste disposal.

⁵ Data solely reflects exports voluntarily provided by Bethlehem Apparatus.

⁶ The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is a multilateral environmental agreement negotiated under the United Nations Environment Program (UNEP). The Convention requires exporting countries to notify and obtain consent from receiving countries, as well as any transit countries of the proposed shipment. Although the United States has signed the Convention, it is not a Party; Canada became a Party in 1992. Parties to Basel are prohibited from hazardous waste imports/exports with non-parties absent a bilateral agreement stipulating provisions which are not less environmentally sound than those provided for by the Basel Convention.

Disposal

In Canada, provincial and territorial governments establish measures and criteria for licensing hazardous-waste generators, carriers, and treatment facilities, in addition to controlling movements of waste within their jurisdictions. While there are no national or province-wide standards in Canada prohibiting land disposal of mercury wastes, Canadian facilities have specific standards established in their operating permits, some of which may allow disposal of elemental mercury and mercury compounds after treatment. However, as a practical matter, Stabllex Canada Inc.,⁷ located in Quebec, is currently the only hazardous waste treatment and disposal facility which accepts high concentration mercury wastes. At the Stabllex facility, mercury compounds are stabilized by mixing the waste with silicate materials (concrete) before being transferred to its permitted landfill for environmentally sound disposal. (See: <http://www.stabllex.com/en/>)

Issues, Evaluation, and Recommendations for Mercury Compounds as Waste

Issues Presented by the Export of Mercury Compounds

Due to the absence of a land disposal option in the United States for most high concentration mercury waste, U.S. waste generators have exported such wastes to Canada for treatment and disposal for a number of years. At least one U.S. waste management company has previously identified the cost of implementing the RCRA hazardous waste treatment requirements for high concentration mercury waste (retort/recover mercury) as motivating generators to seek alternative and lower cost approaches to mercury waste management at Canadian waste disposal facilities.⁸

Implementation of the MEBA elemental mercury export prohibition in 2013 was expected by Congress to result in an increase of elemental mercury within the United States.⁹ Therefore, MEBA also provided for the Department of Energy (DOE) to operate a facility where such elemental mercury could be placed in long-term management and storage as a waste.¹⁰ However, when the export ban became effective on January 1, 2013, no authorized long-term storage facility existed yet to receive that elemental mercury. As a result, there are only two pathways allowed under MEBA by which such elemental mercury can be stored on an interim basis until the MEBA-required long term management and storage facility is open: (1) it may either be stored temporarily at a RCRA permitted TSD facility or (2) a waste generator producing elemental mercury incidentally from the beneficiation or processing of ore or related pollution control activities may accumulate and store its mercury onsite. However, these temporary storage options

⁷ Stabllex Canada Inc. 760 Industrial Boulevard. Blainville, Quebec, Canada J7C 3V4. Referred to in this report as Stabllex.

⁸ See mercury waste management policy paper by Mercury Waste Solutions Inc. (undated, but references mercury waste export data for 1999-2001). See: http://www.mwsi.com/mercuryregulatoryissues/merc_reg02.pdf

⁹ Before the export ban was effective, the United States was a net exporter of mercury. While there is no ongoing primary mining of mercury in the United States, and mercury use in products has declined sharply over the past 20 years, mercury waste is generated as a by-product on an ongoing basis by non-ferrous mining and mineral processing operations, particularly gold mining. See EPA report: Inventory of Mercury Supply, Use, and Trade in the United States, 2020 Report. https://www.epa.gov/sites/production/files/2020-03/documents/10006-34_mercury_inventory_report.pdf

¹⁰ MEBA requires that the long-term storage facility operate under a RCRA hazardous waste management permit, meaning that mercury sent there has been deemed a waste. Owners of mercury may also store it privately, as a product for sale and use in the manufacture of mercury devices or products that continue to be used.

are limited to the mercury for which the TSD or generator has certified is destined for the long-term storage facility.

The ongoing cost of interim storage has resulted in some generators and TSDs converting unneeded elemental mercury to mercury sulfide, followed by export from the United States and disposal at the Stablex, Inc. facility in Canada. Export of high concentration mercury waste to the Stablex facility for treatment and disposal currently provides an option for mercury waste management that does not currently exist in the United States. The most significant volumes of mercury compound exports are of mercury chloride (calomel), an air pollution control residue from gold ore processing and refining (Table 1).

Evaluation of Management Options and Recommendations

RCRA waste treatment regulations prohibit land disposal of high concentration mercury waste, including waste mercury compounds. As such, there is currently no commercial capacity for treatment and disposal of this waste. Management options in the United States for high concentration mercury wastes of all types are limited. Despite DOE's efforts to open and operate a long-term storage facility for elemental mercury, no such facility is currently available. A DOE facility for long-term management and storage of mercury under MEBA was initially designated; however, that designation has been withdrawn.¹¹

Export of high concentration mercury waste to the Stablex facility for treatment and disposal provides waste management capacity that is not currently available in the United States. Because the United States currently does not have the waste management capacity to treat and dispose of mercury compounds due to current RCRA waste treatment regulations, and there is no operational storage facility available to accept elemental mercury at this time, EPA recommends that no further restrictions on the exportation of mercury compounds be imposed.

Conclusion and Overview

The enactment of MEBA in 2008 and the amendments to TSCA in 2016 prohibit, as a general matter, the export of elemental mercury and the export of five mercury compounds from the United States other than for the purpose of disposal. Given that RCRA regulations prohibit land disposal of high concentration mercury waste and there is no operating long-term storage facility in the United States, facilities producing elemental mercury and mercury compounds will continue to store mercury on a temporary basis or rely on the Stablex facility in Canada for treatment and land disposal.

EPA therefore recommends that no further restrictions on mercury compound waste exports be imposed.

¹¹ In late 2019, DOE designated a facility and established a fee structure for the long-term management and storage of mercury as required by MEBA. However, both actions were challenged in court, and as part of a settlement agreement with the litigants, DOE withdrew the storage site designation and the fee rule was vacated and remanded. See 85 FR 63105, October 6, 2020.